Flammable mass

The invention relates to a flammable mass. Such flammable masses are already known in various embodiments. Reference is made, for example, to spirit, including spirit modified in the form of a gel. Furthermore, reference is also made to flammable resin formulations, such as are known, for instance, under the trade name ESBIT.

The invention relates therefore in particular to a flammable mass in the form of a firelighting aid, for instance a barbecue firelighter, a fireplace firelighter or an oven firelighter. Furthermore, the flammable mass can also be used, for example, for a fondue burner. For this they can be accommodated in a vessel, for instance an aluminium pot, such as the burner for a spirit modified in the form of a gel mentioned above. The pot can, in a conventional manner, consist of a metal foil, for instance an aluminium foil or the like.

In the case of individual known flammable masses of this type, the heating value, for example, is not especially high. Also, in the case of certain flammable masses of this type toxicity has been perceived to be disadvantageous. For instance with respect to storage in the home.

lno. a1>

It is therefore an object of the invention to provide a further flammable mass which is as advantageous as possible.

lno. a2> ~~This object is achieved with the subject matter of~~

~~Claim 1 which relates to a flammable mass of paraffin~~ having inorganic particles disposed in a homogeneous distribution in paraffin. According to the invention, it has been revealed that a fine distribution of inorganic particles in the paraffin makes this flammable at the surface. It is known for burning paraffin, that is to say in the case of candles, to place a wick in the paraffin. This has proved to be no longer necessary if, as described, inorganic particles are disposed in a homogeneous distribution in the paraffin. To this extent it is even possible, by concentrating the particles only in a central region of a candle, thin in the manner of a wick, to replace a customary wick by this. In this specific example the invention also comprises a candle thus formed. A number of possibilities are provided with respect to the particles. They can be, in particular, silicic acid particles, specifically silica. The size of the particles can vary. However, preferably, the size is in the range of fractions of millimetres down to nanometres. In contrast, the size can also be selected to have an upper limit up to the millimetre range. Specifically, a range can be provided, for example, (situated in the lower part of the abovementioned spectrum) from 7×10^{-3} to 7×10^{-2} µm. In order, in this regard, to obtain the sought-after mass (paraffin character, coherent mass, no powder characteristics), the weight ratio of paraffin to silicic acid should be greater than or equal to 80 (paraffin) to 20 (silicic acid). "Paraffin" is here chosen to be representative ~~of all other variants mentioned below.~~

With respect to the silicic acid, in particular what are termed precipitation silicic acids are preferred. They are prepared, as is known, from an aqueous alkali metal silicate solution using mineral acids. From this

a silicic acid powder is then finally produced. In addition, what are termed pyrogenic silicic acids are also preferred. These are highly disperse silicic acids which are prepared by flame hydrolysis. Pyrogenic silicic acids have a virtually pore-free surface. Significantly fewer OH groups are bound to this than in the case of precipitation silicic acids.

These synthetic silicic acids are generally hydrophilic and can be utilized for this property. However, silicic acids which may have been made hydrophobic by a further treatment can also be used.

It is essential that the flammable mass is one having paraffin character. Silicic acid is added to the paraffin heated to a liquid state, with the silicic acid also having a thixotropic action in a manner known per se. A gel-like state results. After cooling, the flammable mass has a paraffin-like character resembling candle material with respect to its nature and its external properties. It is characteristic that when the flammable mass is melted, it first transforms into, or passes through, a gel-like state.

With respect to the paraffin, a suitable paraffin is firstly that from which candles are customarily produced. That is to say paraffin produced from slack wax, a petroleum residue product, for instance by sweating to remove oil.

Furthermore, however, synthetic paraffin, as produced using the Fischer-Tropsch synthesis, can also be advantageous. FT paraffins principally only consist of normal paraffins. More than 90% are usually n-alkanes. The remainder are isoalkanes. The chain length is C30 to about C100, but also in part less, that is to say

from about C18 at a gradation (also solidification point SP) from approximately 68°C to approximately 105°C. On the FT paraffins in general, reference is also made, for example, to A. Kühnle in Fette, Anstrichmittel, 1982, pages 156 to 162.

Obviously it is also possible to use a mixture of conventional paraffin produced from slack wax together with FT paraffin.

It can also be a substance as has already been disclosed in relation to transparent candle bodies. In this case it is a mixture of white oil with a copolymer. For instance with a diblock, triblock, radial block or multiblock copolymer. In particular with a polymer which has been disclosed under the trade name "Kraton G". The latter is a thermoplastic rubber. A candle body of this type is also generally not solid, but has a gel-like structure. In this context, reference is made, in particular, to WO 96/34077 and WO 97/08282, also. The disclosure content of these publications is hereby incorporated in full into the description of the present application, also for the purpose of incorporating features of these prior applications into claims of the present application.

When a substance as described in the previous paragraph is used exclusively or very predominantly, obviously a character for the flammable mass results as is customary for this substance, that is to say no longer corresponds in every respect to the conventional candle and paraffin characteristics. The same applies to the starting material described below which is further modified.

Furthermore, it can also be a substance which, in

addition to the hydrocarbon oil previously mentioned, also called white oil, also comprises synthetic paraffins (the FT paraffins already described above). The latter preferably in a chain length of C18-C20. In this context, reference is also made to PCT/EP98/07300 and the disclosure content of this publication is also incorporated in full into the present application, also for the purpose of incorporating features of the said publication into claims of the present application.

The paraffin mentioned and the further candle masses mentioned can be used with the most widely varying melting points. However, it is advisable to use masses having relatively high melting points, since, then, during burning the solid structure is substantially retained.

In a further advantageous embodiment, it is provided that the paraffin comprises an additive improving the combustion process. An additive of this type can be, in particular, a metallocene. Surprisingly, by this means, the combustion operation proceeds in a greatly reduced-soot manner, up to a virtually soot-free manner. Among the metallocenes, in turn, ferrocene is particularly preferred.

The inorganic particles can be present in the paraffin in a mass fraction of 1 to about 30%. The combustion-improving additive, in contrast, is preferably present in the flammable mass in portions from 10 to 400 ppm, furthermore also up to 0.5% by volume.

The flammable mass can also be fabricated as a waxy block. However, it can also be provided in powder form.

The said homogeneous distribution of the inorganic

particles in the paraffin is preferably three dimensional. However, in individual cases, it can also be sufficient to provide only an upper layer with the finely distributed particles. In the course of the burning process, these particles, which do not burn themselves, then sink down and thus always remain as particles required in the burning layer.

Example experiments have been carried out, firstly with a flammable mass according to the present description, and secondly with a conventional barbecue firelighter which principally consisted of organic constituents (wood fibres) together with traces of silicon and magnesium. Furthermore, comparison experiments have also been performed with respect to a commercially conventional barbecue firelighter consisting of a waxy mass.

Regarding the flammable mass according to the present description, it is a mass based on conventional paraffin produced from slack wax having a melting point of approximately 52-54°C. To this paraffin were added 8% (per cent by weight) of precipitated silicic acid particles of a mean size of 12 nanometres.

In this case, for the mass according to the invention (weight 1.9143 g there resulted a significantly longer burning time (namely 8.53 min) compared with the commercially conventional barbecue firelighter (weight 1.7659 g, burning time 4.4 min).

It was of great importance, however, that what are termed the PAH values [EPA 1 to 16] (polycyclic aromatic hydrocarbons) were significantly reduced in the mixture according to the invention (37.9 mg/kg compared with 3 271 mg/kg).

The heating value of the two samples was virtually identical.

A further experiment was also performed in which ferrocene was additionally added (0.5%) to the mass according to the invention. In this case, compared with the mass according to the invention, a significantly reduced burning time resulted (5.5 min), with, however, somewhat increased PAHs (179.7). When ferrocene was used, the nitrogen output was also lowest overall (9.63 mg/kg compared with 10.5 mg/kg of the first-used mass according to the invention and 13.68 mg/kg of the known comparison mass).

The chlorine and sulphur values for the mass according to the invention additionally admixed with ferrocene were slightly increased compared with the mass without ferrocene (chlorine 99.7 compared with 89.2 mg/kg without ferrocene, sulphur 43.1 compared with 35.0 mg/kg without ferrocene), but in contrast were further significantly lower than in the comparative mass (chlorine 96.1 mg/kg and sulphur 239 mg/kg).

The comparison experiment with the barbecue firelighter in the form of a commercially conventional waxy mass found that also in this respect the PAH values were significantly lower (comparison mass: 97.2), provided that a combustion promoter such as ferrocene was not used. The chlorine and sulphur values were also noticeably or significantly lower (in the case of the comparison mass chlorine: 96.4 mg/kg and sulphur 195.7 mg/kg). This is also the case compared with a flammable mass as described here with addition of ferrocene. In contrast, the burning time in the case of the commercially available waxy mass was comparable

with the burning time already specified above for the mass based on organic constituents, that is to say 4.5 minutes. However, in addition, there is the fact that in the case of the known comparison mass a smouldering time can be observed, that is to say 5 minutes, which, in the case of the mass described here, virtually did not occur (except in the case of addition of a combustion enhancer, in that case a smouldering time of 1 minute was observed). Finally, the waxy comparison mass also had a significantly lower heating value, namely only 28 500 kJ/kg compared with 40 000 to 41 500 kJ/kg in the case of the remaining samples (sample according to the invention and further comparison sample). Furthermore, the samples according to the masses described here further differed starkly from the comparison samples with respect to the combustion state. This is obviously due to the silicic acid constituents. Considered specifically, the combustion residue in the case of the samples described here was about 2 to 10 times higher.

All features disclosed are pertinent to the invention. In the disclosure of the application, the disclosure content of the associated priority documents (publication of the prior application) is also incorporated in full, also for the purpose of incoporating features of these documents into claims of the present application.